Abstract # 44

The Effectiveness of High-Fidelity Simulation in the Training of Anesthesia Providers: A Meta-Analysis of Prospective Trials

Abstract Type: Meta Analysis/Review of the Literature
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Background: In 1969, Abrahamson reported the positive Results of a training experiment to teach endotracheal intubation to anesthesia residents using a computerized manikin known as "Sim One." Despite leading this expansion of innovative technology, the anesthesia community remains undecided about its usefulness. Over the past decades, conflicting results have contributed to debate over whether simulation (sim) education is worth the time and effort. The purpose of this meta-analysis (MA) was to examine the effectiveness of sim-based education for anesthesia training of technical and nontechnical skills. We excluded studies that solely evaluated self-reported changes. We hypothesized that available quantitative evidence would support use of sim for anesthesia training. Secondarily, we attempted to determine whether sim was more useful for teaching technical vs nontechnical skills to trainees v.s. experienced providers.

Methods: 81 published articles were retrieved from Medline and Web of Knowledge databases using search terms simulation, simulation training, and high-fidelity simulation in conjunction with anesthesia or anesthesiology. To be included in the MA, studies had to fulfill the following criteria: 1) use of high-fidelity sim was a significant component of training, 2) participants were trainees or providers of anesthesia skills, 3) training effect was compared between at least two groups or at two or more times, and 4) necessary statistical information was reported. Cohen's d was calculated as a measure of effect size (ES).

Results: 505 participants from 16 prospective trials were included in the MA. The Cohen's d ES ranged from -.08 to 1.77 (see Fig 1). Though almost half of included studies had nonsignificant Results, the majority utilized small sample sizes. Using MA Methods to aggregate across studies and correct for sampling error, an average Cohen's d of 0.72 was obtained (95% CI 0.54±d=0.90), which can be classified as a statistically significant moderate to large ES. The positive benefit of sim training was not moderated by type of skill (technical vs nontechnical), experience (trainee vs provider), or evaluation Method (clinical vs sim performance vs written test).

Discussion: High-fidelity sim has a significant and positive training benefit for anesthesia providers. Further research is needed to demonstrate improved clinical performance and pt outcomes after sim education and to compare cost-effectiveness with other training Methods.
Figure 1: Forest plot displaying Cohen’s $d$ effect sizes with 95% confidence intervals. Several studies yielded more than one effect size due to multiple outcomes measured, such as post-training performance of both technical and non-technical skills (e.g., communication or leadership). The 0-axis represents no training effect, and effect sizes with confidence intervals above the x-axis represent a positive training effect.